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The Court held that a showing of a suggestion, teaching, or motivation to combine prior art references is an essential component of an obviousness holding. The Court emphasized that this need for specificity pervades precedential authority and reinforced the requirement that teachings of references can be combined only if there is some suggestion or incentive to do so (*In re Fine*, 837 F.2d 1071, 1075, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988)).

That precedential authority includes: *Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1124-25, 56 USPQ2d 1456, 1459 (Fed. Cir. 2000) ("a showing of a suggestion, teaching, or motivation to combine the prior art references is an 'essential component of an obviousness holding'") (quoting *C.R. Bard, Inc., v. M3 Systems, Inc.*, 157 F.3d 1340, 1352, 48 USPQ2d 1225, 1232 (Fed. Cir. 1998)); *In re Dembiczak*, 175 F.3d 994, 999, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999) ("Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references."); *In re Fine*, supra ("teachings of references can be combined only if there is some suggestion or incentive to do so.") (underline in original) (quoting *ACS Hosp. Sys., Inc. v. Montefiore Hosp.*, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984)).

The current requirement for a prima facie case of obviousness under 35 USC §103 is that there must be:

"...some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references." (*In re Fritch*, 972 F.2d 1260, 23 USPQ 2d 1780, 1783 Fed. Cir. 1992). [underlines added]

Directly contrary to *In re Bozek*, supra, is *In re Dance*, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998), which states there must be some motivation, suggestion, or teaching of the desirability of making the specific combination that was made by the applicant.

Since the Examiner has impliedly concluded in the Final Rejection of 10/02/2002 page 3, lines 13-14, that there is no motivation expressly articulated in either reference, the Applicant believes the motivation to be based on the Examiner's personal knowledge so Examiner Affidavit pursuant to 37 CFR §1.104(d)(2) (2002) disclosing the Examiner's personal knowledge is requested.

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Also on August 2, 2001, in *In re Zurko* (No. 96-1258), the CAFC held that the Board could not simply reach conclusions based on its own understanding or experience, or in its assessment of what would be "basic knowledge" or "common sense". Rather, the Board must point to some concrete evidence in the record in support of its findings. Therefore, documentary evidence is respectfully requested pursuant to MPEP §2144.03 to accompany the Affidavit above if the rejections are maintained.

*Rejections under 35 USC §103*

Claims 1-20 are rejected under 35 USC §103(a) as being obvious over admitted prior art (FIGs. 1A-1C and Specification pages 1-7, hereinafter "APA") in view of Wang et al. (USPN 5, 629, 237, hereinafter "Wang").

Applicant respectfully traverses the rejections since the Applicant's claimed combination, as exemplified in claim 1, includes the limitation not disclosed in APA or Wang of:

"...a dielectric layer formed over said semiconductor substrate and said semiconductor device, said dielectric layer having a channel opening and a via provided therein; said via having a via entrant angle formed with said channel opening of greater than about 69 degrees..."

Based on the above, the Applicant's claimed invention requires a channel and a via because the Applicant's via entrant angle is defined by a line connecting the rim of the channel and the rim of the via. This may be seen with reference to FIG. 2 and Specification page 7, lines 21-25, which states:

"In the present invention, the second channel opening 103 is configured so that its width at the rims 134 form the via entrant angle 69 with the rim 132 of the via opening 105. This causes the rims 134 to act as a collimator for subsequent plasma or ion deposition processes where the deposition of the second adhesion/barrier layer 138 requires this "channel collimator effect"."

Applicant respectfully traverses the rejections since the Applicant's claimed combination, as exemplified in claim 1, also includes the limitation not disclosed in APA or Wang of:

"...whereby said channel opening forms a collimator for said via..."

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Based on the above, the Applicant's claimed invention requires the channel form a collimator for the via. A collimator is a device or structure for producing a particle beam, such as an ionized metal plasma, in which all the particle paths are substantially parallel.

The APA discloses an integrated circuit chip having a rectangular channel intersecting a cylindrical via (FIGs. 1A-C and specification pages 1-7). APA discloses on Specification page 3, lines 10-20, the problems with APA in that:

"The common problems associated with most of the seed layer deposition techniques are poor sidewall step coverage and conformality, i.e., the seed layer thickness is much higher in wide-open areas, such as on top of the channel oxide layer, in the upper portion of the sidewalls of the channels and vias, and bottom of the channels than in the lower portion of the sidewalls of the channels and vias. To guarantee a minimum seed layer thickness anywhere in the channel or vias, including at the lower portion of the sidewalls, the seed layer thickness in wide-open areas tends to be much higher. As the width of the channels and vias have decreased in size due to the size reduction in the semiconductor devices, an excessively thick seed layer in the wide-open areas interferes with the subsequent filling of the channel and vias with conductive materials leading to the formation of voids. These voids lead to connection and electro-migration failures."

Based on the above, APA has problems with guaranteeing seed layer thickness in view of the decreasing width of the channels and vias. There is no suggestion of any particular relationship between the channels and vias.

Wang does not disclose a channel or seed layer and discloses a cylindrical via having a bevel or taper intersecting a planar surface; i.e., a cylindrical via having a conical opening such that the top of the via has a larger diameter than the bottom of the via. The angle of the bevel of the via relative to the top of the via is the Wang "angle of entrance". The Wang via is formed in a number of steps as follows as disclosed in Wang col. 3, lines 39-64, through:

"Refer now to FIG. 2 through FIG. 6, ...a method of forming a tapered contact via hole with a high aspect ratio. ...

...FIG. 2, a first via hole opening 32 is then formed in the insulating layer 30

...FIG. 3, the first via hole opening is extended to form a second via hole opening 34

...FIG. 4, the second via hole opening is extended to form a third via hole opening.

... FIG. 5, the third via hole opening is extended to form the contact via hole 38.

...FIG. 6, ...the formation of the contact via hole 38 is completed. In this case there is no re-entrance profile formed at the entrance to the contact

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via hole and the angle of entrance 54 into the contact via hole is substantially less than 90°...."

From the above, it is apparent that Wang first creates a hemispherical first via opening 32 under a masking layer 40, extends the hemispherical opening downward with a cylindrical opening 34, forms a more conical opening 36, and then finishes with a cylindrical opening through the bottom of the conical opening. This leaves a beveled cylindrical via.

Based on the above under *Graham v. John Deere Co.*, 383 Us 1, 148 USPQ 459 (Sup. Ct. 1966), the four factual inquiries would be resolved as follows:

The scope and contents of APA disclose a rectangular channel intersecting with a cylinder with no particular relationship and Wang discloses a beveled via.

The differences between the prior art and the claims at issue indicate that the Applicant's claimed limitation of a structure having a via entrant angle are not disclosed in APA. In Wang, without a channel, it cannot have a via entrant angle as claimed by Applicant. Taking APA and adding the Wang channel will result in a beveled cylinder via intersecting a rectangular channel. Since the beveled cylinder takes up more space than a non-beveled cylinder, this would be non-obvious because it would defeat the objective in APA of reducing the spacing between the channels and vias.

The differences between the prior art and the claims at issue indicate that the Applicant's claimed limitation of a collimeter does not exist in APA. In Wang, there is no disclosure of a structure to cause the particles of an ionized metal plasma to enter the via in parallel because the non-parallel plasma is blocked out by a separate structure such as the walls of the channel in Applicant's invention.

Resolving the ordinary skill in the art would indicate one having ordinary skill in semiconductor device manufacture. APA admits the unobviousness of the Applicant's invention on Specification page 3, lines 21-25, which states:

"A solution, which would form uniform seed layers in vias and result in an improvement in the subsequent filling of the vias by conductive materials, has long been sought, but has eluded those skilled in the art. As the semiconductor industry moves from aluminum to copper and other types of high conductivity materials; it is becoming more pressing that a solution be found."

Wang admits that it is concerned with forming a beveled hole by stating in Wang col. 1, lines 31-33:

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"The importance of beveled contact holes has been recognized for some time and many have worked on methods of achieving them."

It is respectfully submitted that Applicant's invention does not disclose a beveled contact hole and the angle of entrance of Applicant's invention would be described as 90° as shown in Wang FIG. 2.

In considering the objective evidence present in the application indicating obviousness or unobviousness, it is respectfully submitted that this should be resolved in favor of unobviousness because neither APA nor Wang discloses Applicant's claimed entrant angle or collimator structure.

It is submitted that the combination of APA and Wang would teach a channel having a beveled opening into a cylindrical opening would be taught away from since the conical openings would prevent the vias from being placed close together and therefore prevent decreased size in semiconductor devices.

Based on the above and even applying the factual inquiry set forth in *Graham v. John Deere Co.*, 383 US 1, 141 USPQ 459 (SUP. CT. 1966), all four factors would mitigate towards the unobviousness of Applicant's claims.

It is respectfully submitted that a prima facie case of obviousness under 35 USC §103 cannot be made for claims 1-20 because there is nothing to suggest the combination. As explained in *Laitram Corp. v. Cambridge Wire Cloth Co.*, 226 USPQ 298 at 293n (D. Md. Mag. 1985), *aff'd in part, rev'd in part, and remanded*, 785 F.2d 292, 228 USPQ 935 (Fed. Cir. 1986), cert. denied, 479 U.S. 820 (1986):

"The question is whether the prior art, considering its scope and content and the level of ordinary skill, must itself suggest the combination of separate elements into the claimed invention in suit, not just whether it illustrates separate elements..."

It is respectfully submitted that APA and Wang in combination do not teach or suggest the Applicants' claimed invention as required by 35 USC §103(a) under the proper standard of review, that they individually teach away from Applicant's claimed invention under 35 USC §103(a), and that they teach away from combination with each other such that a prima case of obviousness cannot be made under 35 USC §103(a).

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**Conclusion**

In view of the above, it is submitted that the claims are in condition for allowance and reconsideration of the rejections is respectfully requested. Allowance of claims 1-20 at an early date is solicited.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including any extension of time fees, to Deposit Account No. 01-0365 and please credit any excess fees to such deposit account.

Respectfully submitted,



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